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Sibley on a February day

Shipbuilding --- A Career for Engineering

HAROLD F. NORTON, M.E. '96

THE notion that the naval architect—certainly one at a shipbuilding yard—spends most of his time designing new ships to suit his fancy, based upon knowledge imbibed in his course at college, is of course fallacious. The truth is that he spends much of it in trying to see that there are enough men of the right sort in the technical department and the drawing rooms to produce promptly the plans needed to build the ships. Much of his time is spent in looking after and replying to the voluminous correspondence of the office; in the time that is left he advises the various assistants and leading men on their particular functions in carrying out the design and producing the plans.

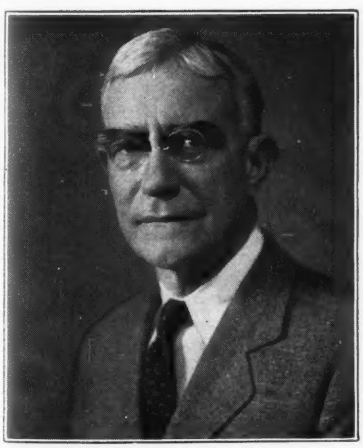
Usually the design itself is handed to the management of the shipyard by the owners of the prospective vessel in the form of contract plans and specifications prepared either by an employee of the owners called a "naval architect", or "marine superintendent", or in the form of contract plans and specifications prepared for the owners by some outside firm of "naval architects". If the making of the contract plans and specifications is in the hands of one of the owner's employees, he is rarely permitted to produce anything distinctly his own, but is usually required to follow closely other ships of the owners, or the ideas of other officers of the company. The same restrictions apply more or less to any outside firm employed to make the contract plans and specifications. In any case, it is usually only the most general direction of the design work that is possible to the head of the firm, while the working out of the details of the design is turned over to his staff. The naval architect of the shipyard must of course have checked by his technical department all design calculations and characteristics to make sure that the ship as built will (1) fulfill all guarantees of the contract, (2) be and do in general what is intended, and (3) fulfill all requirements of the Classification Society, the Bureau of Marine Inspection and Navigation and other government agencies. Occasionally the design of a yacht or other small craft may be almost the work of one man, and the time was when in some cases this applied to larger vessels; but in recent years most designs, even when ascribed to some one person, are really a combination of many ideas worked out by a considerable number of men.

The same applies to engineering. The chief engineer of course oversees the work of his staff in producing the necessary design calculations and working plans for building the machinery, but he rarely has the privilege of making it exactly according to his own taste. All large work in these days is a combination of many ideas and the product of the brains and hands of many men, and this is of course quite as it should be.

Opportunities

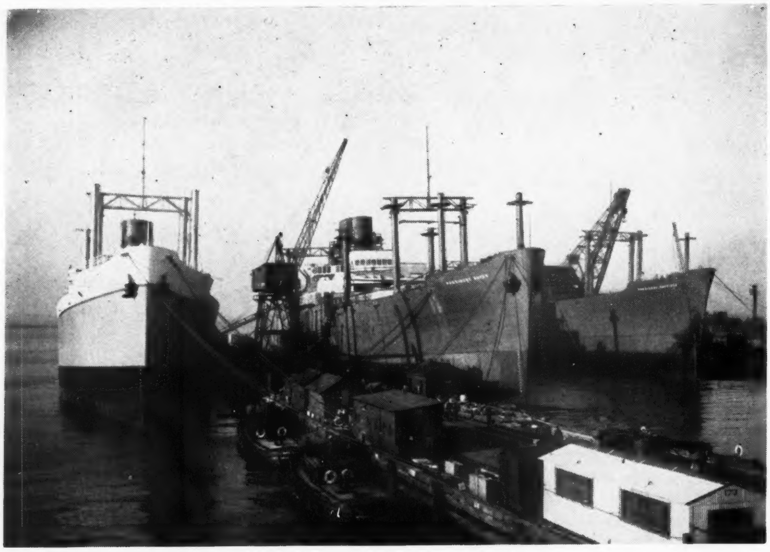
No young engineer fresh from college, no matter how complete his course or how high his attainments, can expect very soon to have any large part in the determination of the design characteristics of either hull or machinery. It is a long road to the top, and even if he gets there, he finds himself quite limited. But he can very soon take his part in working out some of the details, and therein lies the fascination of shipbuilding—seeing one's ideas grow into realities in connection with ships to sail the seas. It makes the effort somehow worth while even if one does not become very wealthy in doing it.

But what about the present opportunities in shipbuilding for the young engineer? They seem to be considerable if he is well grounded in engineering and thoroughly willing to work and study. The amount of shipbuilding on hand at present is of course enormous. The November, 1941, issue of the Bulletin of the American Bureau of Shipping mentions over 1100 vessels as now under construction or contracted for in American yards, and this



HAROLD F. Norton, M.E. '96, last year became consulting naval architect for the Newport News Shipbuilding and Dry Dock Company of Newport News, Virginia, after serving as naval architect for the company for over twenty years.

He is a member of the Society of Sigma Xi, a Council member of the Society of Naval Architects and Marine Engineers, a member of the Institution of Naval Architects and of the Committee on Naval Architecture of the American Bureau of Shipping.



Examples of modern shipbuilding

does not include Navy vessels, of which there are hundreds. Shipbuilding has had its ups and downs and probably always will, but surely we in America have at last learned our A B C'c about ships and will never again let shipbuilding decline seriously. The Maritime Commission seems to think so. Surely there will be a dearth of ships and plenty for American ships to do after this war is over.

In the ship yards there is now work for young engineers both in the drawing offices and the yard. In the yard there is opportunity to begin as helpers or mechanics in machine shops, in steam engineering, as electricians, pipe fitters, sheet metal workers, ship carpenters, ship riggers, mold loftsmen, erectors, ship fitters and welders. Or one might posibly find a place as a "runner" in the office of one of the superintendents; that is, one who is sent out to various parts of the yard to report upon how jobs are coming along or to transmit directions concerning them. If he prefers drawing, he can probably find it in either hull, machinery, piping, or electrical drawing rooms. If he prefers calculations, he may find work either in the engine or hull technical departments. He might possibly find an opening in the chemical, testing, research, and metallurgical department.

There are plenty of opportunities in shipbuilding for almost any kind of engineering talent and training, but there always seem to be difficulties about finding the right man for the spot; sometimes a really good man finds difficulty in finding a spot to exactly suit him. Even in a large organization, there are not many specialists of any particular variety. There are usually openings for the general run of mechanics or draftsmen, particularly in these strenuous times. Perhaps the best thing to do is to take almost any job one can get, and then be on the lookout for the particular kind of job one thinks he would like best and for which he thinks himself best fitted. There are always opportunities for men who are ready to work hard and grasp them, but it must be remembered that there are not many presidents, vice-presidents, yard managers, superintendents, chief engineers, and naval architects. A fledgling engineer, even a clever one, may hardly expect to be one of the above group in any very short time after he starts on the job. There are to be sure a goodly number of assistants, quartermen, supervisors, chief draftsmen, assistant chief draftsmen, chargemen, and leading men. It is something of a surprise how comparatively few of them are college graduates and how many are ex-apprentices. It is also somewhat remarkable to notice how many of the best technical experts are naturalized American citizens who may or may not have received most or all of their technical training abroad. You may be surprised to know that some of the Navy Department's best mathematics experts are foreign born and trained. It makes one doubtful whether American engineering colleges and universities are giving the students as good a training as they should in shop work, machine design, mechanics, and advanced engineering mathematics. One cannot know how to design castings and forgings

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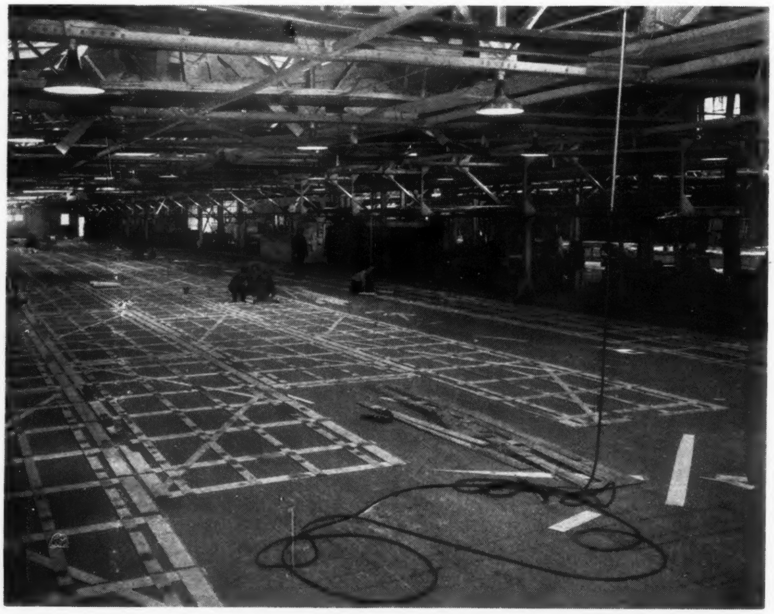

The mold loft, where patterns are laid out

Training Inspectors for Defense Industries

PROF. LYNN A. EMERSON

Professor of Industrial Education

AS THE industries of our country have developed from a stage of relatively low standards of precision to those of the present day, where the supermicrometer is a common standard of measurement, the need for inspection of manufactured parts has increased greatly. This is particularly true under conditions where millions of dollars in orders have been allocated to sub-contractors, and the prime contractors are faced with the necessity of maintaining standards so that parts and sub-assemblies manufactured by the sub-contractors will fit accurately into the final total assembly.

Inspection is a broad field, and hundreds of kinds of inspection are needed in the manufacture, operation, and service of the varied types of products manufactured and fabricated today. National defense contracts cover a great range of products, requiring many types of inspection service. This article deals with two important aspects of the total program: the inspection of machined parts, tools, and gages, and the inspection practices incident to aircraft manufacture.

Inspectors are urgently needed in these fields. Men and women who are trained in the various techniques of inspecting machined parts are needed in most of the machine tool industries, which are expanding their programs to an all-out effort. Inspectors of the many types of tools needed for production, such as dies, jigs, and fixtures, are needed in large numbers. Many additional inspectors are needed for checking the various gages used by production workers and by other inspectors.

The rapid expansion of the aircraft industry has diluted the inspection staff to the point where many additional persons have to be trained as receiving inspectors, inspectors of fabricated parts and sub-assemblies, inspectors of forgings, castings, and machined parts used in aircraft, inspectors of jigs and fixtures, and for many other inspection duties.

Need for Special Training

Prior to the present emergency, the needs for inspectors were met by taking men from the production line or the tool room and giving them a sort of apprentice training under other inspectors, or by short intensive training programs offered in the plants and the arsenals. These methods still have a most important place in the total program of defense training, and for certain types of inspection practice this is still the best method of developing trained personnel. But the aircraft plants and the machine tool industries, especially the smaller plants, have such a big job on their hands in maintaining production schedules that many of them are now looking to the schools and colleges for inspection training programs which will supplement the training they are providing in the plants.

To help meet this need, many vocational schools and engineering colleges are now offering training programs for inspectors, of pre-employment type or as supplementary courses for persons already employed. This was a new type of training for most of these schools and colleges, and few of them had the necessary information concerning courses of study, equipment, and other pertinent data needed in undertaking such training.

In the summer of 1940, shortly after the National Defense Training Program got under way in the vocational schools of the nation, the New York State Education Department foresaw the need for organized instructional material which might be furnished to the schools undertaking the various training programs, and established its first National Defense Curriculum Laboratory. In this laboratory a series of monographs was developed covering courses of study in machine shop practice. In the fall of that year other laboratories came into being concerned with the development of instructional material in aircraft fabrication and the like. Among these laboratories was one dealing with the problem of developing instructional material for the training of inspectors,

FTER being graduated from the U. of Minnesota in 1911 with an E.E. degree, Professor Lynn A. Emerson engaged in graduate work in education first at the U. of Chicago and later at N.Y.U., where he received his Ph.D. in 1932.

After considerable experience in teaching, in education, and in industry, Professor Emerson in 1938 left his post as assistant superintendent of schools, in charge of vocational education, for the Yonkers public schools and came to Cornell University as professor in industrial education.

President of the National Association of Industrial Teacher Trainers, Professor Emerson is at present engaged in preparing manuals to help train teachers and inspectors for war work. It is about this work that he writes.

Demonstration of the use of calipers

under the direction of the writer of this article.

Through cooperation of the Board of Education of New York City, space was provided for carrying on the work in Brooklyn from October, 1940 through June, 1941, when the laboratory was moved to the Cornell campus. It is now housed in the basement of Sibley Dome, where close cooperation is possible with the staff and facilities of the College of Engineering.

The procedure followed in developing the instructional material for inspector training which has come out of this laboratory included a number of important steps. A general analysis was made of the field of inspection, and decision reached with respect to the areas of inspection service which should be intensively studied. When this had been delimited to the field of inspection of machined parts, tools, and gages, and of inspection in aircraft manufacture, competent ordnance and aircraft inspectors were recruited from the industries for evening work on a part-time basis. Two former ordnance inspectors were loaned by the Brooklyn Technical High School to assist in the preparation of the material, and the necessary stenographic and drafting personnel were secured.

The first stage of the work included an extensive analysis of the duties of inspectors and the instruments with which they worked. The hundreds of items which came out of these analyses were classified, and the instruction topics were arranged in suitable unit courses. Decisions were reached concerning the manner in which the training was to be given, standards were developed covering the qualifications of teachers and trainees, and definite plans were made concerning the formation of the instructional material. After this preliminry work had been accomplished, the writing of the material was started.

The instructional material for the training of inspectors of machined parts, tools, and gages was developed in the form of laboratory manuals and of outlines for the classroom end of the training. Most of the training is planned to be done in inspection laboratories, where the trainees learn the use of the various measuring instruments and gages through practice in the inspection and checking of a wide range of sample machined parts, tools, and gages. The laboratory assignments start in with simple measurements using the steel scale in checking the dimensions of blocks, or with limit gage inspection using plug, ring, and snap gages and extend through a total of 78 different assignments. As the course progresses, the micrometer measurements are made in ten-thousandths instead of thousandths, surface plate set-ups are used involving height gages and test indicators, tolerances become closer, and the inspection parts become more complicated. The course includes certain assignments which require the use of the toolmakers' microscope, the sine bar, or the projection comparator. Many assignments are based on precision gage blocks.

The material developed in the Curriculum Laboratory included a special monograph designed to assist school administrators in organizing the program of inspection training. In this monograph were included suggested laboratory plans, lists of equipment, and drawings of the parts to be used for inspection laboratory training.

The series of monographs developed for the training of inspectors for aircraft manufacture provides laboratory manuals for training in the use of the instruments employed in aircraft inspection, with assignments dealing with raw material inspection, component aluminum alloy parts and sub-assemblies, rivet inspection, weld inspection, and the like.

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Demonstration of the vernier height gage

Electric Shock — Killer or Healer?

ROBERT S. ROCHLIN, EE '44

Cuts courtesy HYGEIA

EVER since Benjamin Franklin flew his famous kite in a thunderstorm and received an electric shock through the wet cord, scientists, medical men, and engineers have sought to find out what happens when a current of electricity passes through the human body. Much valuable and interesting data has been collected on the subject, but only a few unrelated facts have become generally known. The following survey of this field attempts to treat such popular questions as: What voltage does it take to kill a person? Is the 110-volt house current dangerous? How do doctors use electricity to save lives? What is the best way to revive a victim of electric shock?

First we shall discuss accidental electric shock; second, the electrocution of criminals; and third, the uses of electricity in medicine.

Threshold of Sensation

An electric current passing through the body involves different mechanisms, each of which will be considered separately. The first is mere sensation of the current—a tingling or warmth caused by a stimulation of the sensory nerve endings in the skin. Because of large variations in contact impedances, the current which actually passes through the body is the factor to consider rather than the voltage applied. For a 60-cycle current the threshold of sensation (the lowest current at which sensation is perceptible) is in the neighborhood of .001 ampere.

Body resistance varies from about 38,000 ohms just tapping a metal plate with the dry hand to about 1500 ohms with the hand immersed in a conducting solution. As can be seen from Table I, a better contact not only lessens the body resistance but increases the current which can be tolerated without sensation. The four types of contact mentioned in the table refer to tapping a metal plate lightly with the finger, pinching a wire tightly between thumb and forefinger up to the first joint, gripping an electrode tightly in the right hand, and, finally, immersion of the hand in salt water.[1]

The next body mechanism affected by an electric current is the muscles, which are caused to contract involuntarily by sufficient current. Tests were made at the University of California[2] on 120 men to find the greatest current at which the subject could voluntarily release an electrode held in his hand.

As the current was increased over the threshold of sensation mentioned above, the muscles of the hands and arms tightened involuntarily. At 6 to 8 milliamperes and above, the discomfort from severe muscular contraction was more evident than the tingling—sometimes even painful. At this point, the subjects were able to release the electrode by making a determined muscular effort. Although one subject was able to let go at 20 milliamperes, the average was about ¾ of that amount—15 milliamperes. These experiments did not use heavy enough currents to cause unconsciousness. An interesting fact observed was that repeated shocks gave a slight immunity. Probably that was partly because the subjects became psychologically conditioned to the experience.

In some types of accidental contact, such as gripping a wire with the hands, this muscular contraction would tend to hold the victim to the wire, but in other types it would help break the contact. It is also possible that the victim could use other unaffected sets of muscles to free himself from the live conductor.

If the circuit through the body included the respiratory muscles, currents of this magnitude could cause stoppage of breathing. If prolonged, asphyxial death would result, but since this is a matter of several minutes rather than seconds, there is opportunity to release and revive the victim. No serious or permanent after-effects are experienced from this sort of shock.

Fibrillation

Currents larger than those causing contraction of the voluntary muscles affect the heart in a strange and dangerous way. Called "ventricular fibrillation," the effect is a disruption of the normal pumping action of the heart and the establishing of a spasmodic quivering and twiching, in which each muscle fiber contacts independently rather than in unison with the others. This cutting off of the blood circulation results in death in a few minutes. Since ventricular fibrillation, once started, is unlikely to cease naturally before death, this threshold of current magnitude is the dangerous one.

Considerable research on fibrillation has been undertaken by Livingston Polk Ferris, Dr. H. B. Williams, Dr. B. G. King and P. W. Spence of the College of Physicians and Surgeons of Columbia University and the Bell Telephone Labor-

TABLE I

Contact	Average Body Resistance ohms	Threshold of Sensation milliamps	Potential Needed for Sensation volts
Tap	37,500	.34	12.75
Pinch	14,000	.76	10.60
Grip	7,350	1.05	7.71
Immersion	1,540	1.18	1.82

1. Thompson, Gordon. Report on appliance insulation in *Electrical World* June 17, 1933; page 793.
2. *Science* February 14, 1941; page 8 of supplement.

Beneficial heating of the deep shoulder muscles by short wave diathermy

tories.[3] After nine years of study, during which they electrocuted over 1400 guinea pigs, rabbits, cats, dogs, pigs, calves, and sheep, they found that currents in the neighborhood of 0.1 ampere lasting for only one second were sufficient to bring about death in animals comparable in size to man. The fibrillation threshold was found to depend upon a number of factors:

(1) Size. It increases roughly with body weight and heart weight.

(2) Current pathway. A leg to leg path can take as many as 15 amperes without inducing fibrillation. However, such currents may cause severe burns unless the shock is short and the contact good.

(3) Frequency. For shocks as long as one second, the 25-cycle threshold is 25% higher than at 60 cycles. The d.c. threshold is about 5 times the 60-cycle value. As the shock duration is reduced to small fractions of a second, the thresholds approach one another.

(4) Duration. There is an inverse proportion, but it is not uniform.

(5) Time of shock in relation to heart cycle (for short shocks of 0.1 second or less).

Successive shocks seemed to have no cumulative effect. Electricity causes fibrillation by giving an abnormal stimulation rather than by damaging the heart itself.

Ferris and his associates confirmed a most amazing fact about fibrillation—that a return to normal pulsation can be frequently produced by a counter shock of high intensity and short duration. This counter-shock must be administered promptly—probably within a few minutes. Artificial respiration should also be used. The investigators state, "Should a counter-shock be applied mistakenly to a coordinately beating heart, the liability of its causing fibrillation is small, and should this occur, another counter-shock probably will arrest the fibrillation and bring back coordinate heart action."

Other investigations[4,5] have also helped to confirm this counter-shock method.

Susceptibility to fibrillation increases with the current up to several times the threshold and then diminishes. At currents around 25 amperes there is very small likelihood of fibrillation. But other serious injury may occur. Primarily, this takes the form of temporary paralysis of the respiratory nerves.

The best bet for victims of these "high-tension" shocks is tireless, patient artificial respiration. High-voltage currents almost never kill the victim outright.[4] Death occurs after a lapse of time much greater than previously believed. Nerve centers are paralyzed, and death results from suffocation if breathing is not maintained artificially. Unless rigor mortis sets in, a shock victim should not be pronounced dead until he has had at least twelve hours of artificial respiration.[6]

The application of heat externally and administering stimulants may also be helpful until a doctor arrives.

In several cases such prolonged first aid treatment has revived men who have received accidental shocks of far greater voltage than those given criminals in the electric chair.[4] For example, Ernest Heglund touched a live wire in a New York City powerhouse a few years ago and took a shock of 40 to 70 amperes. When the power was shut off, his heart had stopped. Yet prolonged medical treatment revived him. About the same time an X-ray technician at Bellevue Hospital, New York, accidentlly touched a live plate and received a 75,000-volt shock. An "iron lung" kept his body supplied with oxygen automatically until the nerve centers renewed their activity.

3. Ferris, L. P., B. G. King, P. W. Spence, H. B. Williams. "Effect of Electric Shock on the Heart" *Electrical Engineering* May, 1936; page 498.

4. Martin, Robert E. "Electric Shocks—Do They Really Kill?" *Popular Science Monthly* July, 1938; page 44.

5. *Science News Letter* May 25, 1940; page 330.

6. Boy Scout *Handbook for Boys* 1941—Articles on artificial respiration and electric shock.

Other effects of shock which have been known to occur are severe burns (worse with d.c. than a.c.), paralysis of some of the muscles, deafness, loss of smell and taste, hysterical phenomena, traumatic neuroses, blindness, and insanity.[7] In general, the chances of recovery will be much greater if the current pathway does not include the brain.

Is 110 Volts Dangerous?

One conclusion which can be drawn from the above discussion is important to everyone. A healthy individual may usually take a shock through the dry hand from ordinary 110 volt house current with no ill effects. But if any portion of the body is wet, the results are likely to be serious or even fatal. Scores of tragic episodes can be cited to drive this point home.

In Newton, Mass., a high-school lad hurt his thigh in a football game. That night he went to sleep with a heating pad on the injured part. The heat made him perspire; the perspiration soaked through the pad, and the boy was found dead in the morning. Good pads are usually equipped with a rubber case to be slipped over them, but these are often mislaid.

A Philadelphia broker came home one day with a kink in his neck. He decided that an electric vibrator and a hot bath would help him. His error was that he applied both at the same time and was electrocuted. Similar incidents involve the use of portable electric heaters while bathing.

7. *Encyclopedia Americana* 1939; volume 10, page 181.

All of these tragedies, and many more which could be cited, involve defective appliances and occur seldom, but statistics are cold comfort to the victims. A few simple rules are recommended.[8] Use porcelain sockets — rather than brass — in kitchen, laundry, and bath. Replace metal pull chains with string. Never touch an appliance while any portion of hands or feet are wet or while standing in water or on a damp floor. Avoid touching two electric appliances at once. And don't buy cheap appliances.

Electrocution of Criminals

Early in the morning of August 6, 1890, twenty-one grim-faced men sat in Auburn State Prison to witness the first capital punishment by an electric current. Before them stood the Chair—the result of many men's ideas put into execution by Edwin F. Davis, an electrician. It was made of stout oak and was fitted with straps, a metal cap, and electrodes.

Thirty-year-old William Hemmler, convicted of murdering his mistress, was strapped in the chair. For 17 seconds there surged through him a charge of 1000 volts. Then a gasp came from the slumping body "probably owing to the mechanical reaction of the victim's lungs to the electric charge."[9]

Press and public raged against the "unnecessary brutality." The method was attacked as "cruel and unusual punishment" in violation of the Constitution. But under the sponsorship of Dr. A. P. Southwick, electrocution was sustained in state and finally federal courts. (Re Hemmler, 1889, 136 U. S. 436). Now it is the official form of capital punishment in 21 states.

Hemmler was kept waiting twelve minutes, but nowadays the time required is only 70 seconds. The latest type of chair has eliminated straps and buckles. By pulling small levers the executioner can fasten the prisoner in place with metal rods and copper strips in less than 5 seconds.

The electrodes are soaked in salt water and adjusted to the individual. The executioner pulls a switch and 2000 volts are applied for five seconds. Then the voltage is reduced to 1000 volts for ½ minute "to prevent sparking and unnecessary burning."[10] Then the voltage is raised and lowered again—five

(*Continued on page 24*)

Short wave diathermy being used to treat sinus trouble. Waves oscillating millions of times a second produce healing heat deep within the affected organ.

The COLLEGE . . .

Ward On Planes

WARNING the assembled engineers not to believe all they read in the newspapers or hear over the radio, J. Carlton Ward, M.E. '14, president of the Fairchild Aircraft and Engine Corporation, addressed the senior lecture group on Friday, January 16, on the accomplishments and expansion of the aviation industry to meet war needs.

To give an idea of the expansion necessary, Mr. Ward pointed out that the total number of planes turned out in the United States from the time of the Wright Brothers' first flight to the fall of Poland to the Nazis did not exceed 30,000. Compare this with the 60,000 planes asked for by President Roosevelt during 1942, and the 125,000 asked for during 1943.

There has been a lot of criticism, Mr. Ward said, about our failure to snap into action immediately. Yet, he said, it requires 1000 planes in reserve for every 1000 in the air, and since the average life of a plane is but three months, 40,000 planes must be manufactured per year to continually have 10,000 in the air.

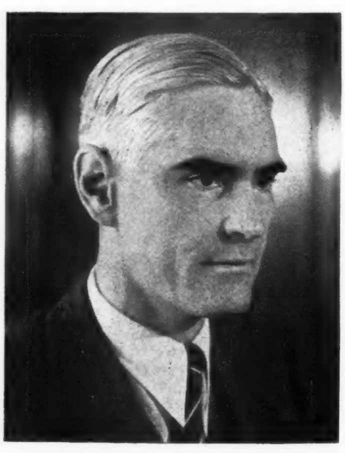
We have the French to thank for the initial development of our wartime production effort, he said; France contracted for $90,000,000 worth of planes in 1939—a year when Major General Arnold, Chief of the Army Air Corps, asked for 424 planes and was granted an appropriation for 49. Had the French not placed this contract and given the aircraft manufacturers the stimulus to expand, the aviation industry would not even be developed to the extent it is today.

During the second half of the period, Mr. Ward illustrated his talk with colored slides of various American planes recently developed. Two-engine patrol bombers, he pointed out, have restricted shipping losses to 100,000 tons a month. Discussing the B-17 Flying Fortress, he said that since it could fly at 30,000 ft., it was virtually safe from attack; the Axis planes are all so sluggish at this altitude as to be ineffective. The only way an Axis plane could shoot down the B-17 would be to climb to 40,000 ft. (which Mr. Ward said would take him almost half a day) and then hover and hope for a B-17 to fly underneath it. The German plane could then dive on the B-17; if its volley missed, it could not come back for a second chance because of the sluggishness already mentioned.

Mr. Ward pointed out that there are several of our plane types which, when subjected to actual fighting conditions, have proved unsatisfactory. For example, it was found that a certain bomber as originally designed was unsatisfactory for two reasons: (1) the gasoline tanks were in the wings—an excellent place from an aerodynamic standpoint—but all a German pilot had to do was shoot an incendiary bullet into the plane's wing, sending it down in flames; (2) it had a blue exhaust flame which was visible at night, giving away the plane's position to the anti-aircraft batteries below.

Leaving the discussion of military planes, Mr. Ward went on to explain the effect of high altitudes on the coordination abilities of the pilots and operators. At 28,600 ft. a bombsight operator did an extremely accurate job; when, however, German anti-aircraft fire—effective to a little over 31,000 ft.—forced the plane to fly at 33,000 ft., the pilot and bombsight operator lost their coordination.

J. Carlton Ward



More About The Navy

ASSISTANT Dean Dr. Arthur S. Adams, director of engineering defense training courses at Cornell, has announced that 119 juniors and seniors in the College of Engineering have applied for enlistment in the V(S) program of the Navy Department and if accepted will be awarded commissions as ensigns in the naval reserve on their graduation.

In addition to enlisting engineering students, Cornell is cooperating with the new, revised V-7 reserve midshipman program. Information has been mailed by the committee on student counseling for national defense to one thousand juniors and seniors in the Colleges of Arts and Sciences, Agriculture, and Architecture and several upperclassmen in the College of Engineering have become interested. This program also protects juniors and seniors from selective service, allowing them to complete their college training and then to enter active service and qualify for commissions in the Naval Reserve.

Two new courses in the astronomy department—Navigation and Nautical Astronomy, and Applied Optics and Instrument Design—which will have particular value to men going into the Army and Navy will also be offered. The former will be given by Professor Boothroyd. This course is the same one that he gave in World War I, at the request of the Navy Department. At that time some 120 men were trained at the University of Washington under the direction of the Naval Academy, and as a result of their training, the great majority of these men were able to meet the high standards of the Academy and take their places as trained navigators. The new course will be of

particular benefit to men enrolling in the V-7 program of the Naval Reserve, and also to persons anticipating service as navigators in aerial or marine corps. It will be devoted to determination of positions of ships or planes from celestial observations, chart reading, dead reckoning, and piloting. Actual practice will include the use of the compass, sextant, and chronometer.

The second course in Applied Optics and Instrument Design is regarded as particularly important to those men who will be concerned with gun sights, bomb sights, and other similar instruments. Specific topics will include telescopes, binoculars, telescope sights, periscopes, range finders, sextants, microscopes, and spectroscopic and light intensity measuring equipment.

Faculty Attend Convention

A DELEGATION of Cornell engineers headed by Dean S. C. Hollister attended the first annual meeting of the newly organized Upper New York State Section of the Society for the Promotion of Engineering Education at Syracuse University on December 6. More than 100 teachers of engineering participated in the program as representatives of the University of Buffalo, the University of Rochester, Clarkson College, Alfred University, and Syracuse University.

The national Society for the Promotion of Engineering Education was founded in 1893 and has as its objective the promotion of the highest ideals in the conduct of engineering education with respect to administration, curricula, teaching and the maintenance of high professional standards among its members.

Following a business session a formal discussion period was held at which addresses were made by Dean S. C. Hollister, Professor C. O. Mackey, and others.

At the closing banquet in the Hotel Syracuse the principal address was made by Willis H. Carrier '01, Trustee of Cornell and chairman of the Board of the Carrier Corporation. He spoke on "An Employer of Engineers Looks at Engineering Education." Other speakers included Chancellor W. P. Graham of Syracuse University and Professor Charles F. Scott, past president of the S.P.E.E.

On the committee in charge of the conference were Professor P. H. Black and Professor G. E. Grantham, secretary-treasurer of the section, both of Cornell.

The CORNELL ENGINEER announces the election of the following men to its staff:

Publication Board

Louis Williams, Arts-Eng. '43
Arnold Tofias, AE '44
Dan Hartmann, AE '46
William Knauss, AE '46
Harrison Parker, ChemE '46

Business Board

Norman Brandt, CE '44
George Ficken, ME '44
David Esperson, ME '44
Anthony Misciagna, AE '44

ASME Elects

At a business meeting of the ASME held Tuesday night, January 20, Robert H. Flack, ME '43, was elected chairman. Alfred J. Sait ME '43 was elected vice-chairman, and Robert E. Warren ME '43 was elected secretary-treasurer.

Arrangements are being made for the second annual ASME banquet. Originally scheduled for Friday night, February 20, the date may have to be changed due to its conflict with the fraternity initiation period set by the Interfraternity Council.

Students And The War

AT the request of the CORNELL ENGINEER, Professor S. S. Garrett, selective service counselor for engineering students, has made the following statement concerning the student's place in the war effort.

BEFORE we were at war, local draft boards were urged by National Headquarters to defer engineering students on the ground that this profession was one of those in which an acute shortage of manpower had been found to exist. Most local boards seem to have acceded in principle, though some of them have required that the student maintain good standing and a few have insisted that his scholastic standing be above average. No word has yet been received by the University regarding any change of policy. Unless and until there is a change, it appears that the best advice to the student is to carry on at his present task, but, if possible, to put more than the usual amount of steam into his efforts.

"The demands for the Army and Navy will, of course rise rapidly as facilities can be created for their maintenance and training. There is talk now of armed forces of ten million men. But these men must be armed and equipped. We must continue to supply munitions to our associates in the war. And we must supply our fighting forces with replacements for the arms, ammunition, tanks, trucks, and ships which will be used, worn out, or lost.

"It would seem, therefore, that while the war has increased the need for men both in the armed forces and in the munitions industries, the relative need has not greatly altered.

"In conclusion, it should be said that in time of peace men may make their decision in accordance with their interests and desires, but when war comes nothing but the need of the country can be considered."

Professor Bangs Presides

SEVERAL members of the faculty of the College of Engineering attended the 62nd annual meeting of the American Society of Mechanical Engineers in New York City, December 1-4. The group included Professors F. O. Ellenwood, J. R. Bangs, J. N. Goodier, P. H. Black, L. T. Wright, and H. J. Loberg.

At the Tuesday morning Machine Design session, Professor Goodier presented a paper on "Torsional and Flexural Buckling of Bars of Thin-Walled Open Section Under Compressive and Bending Loads."

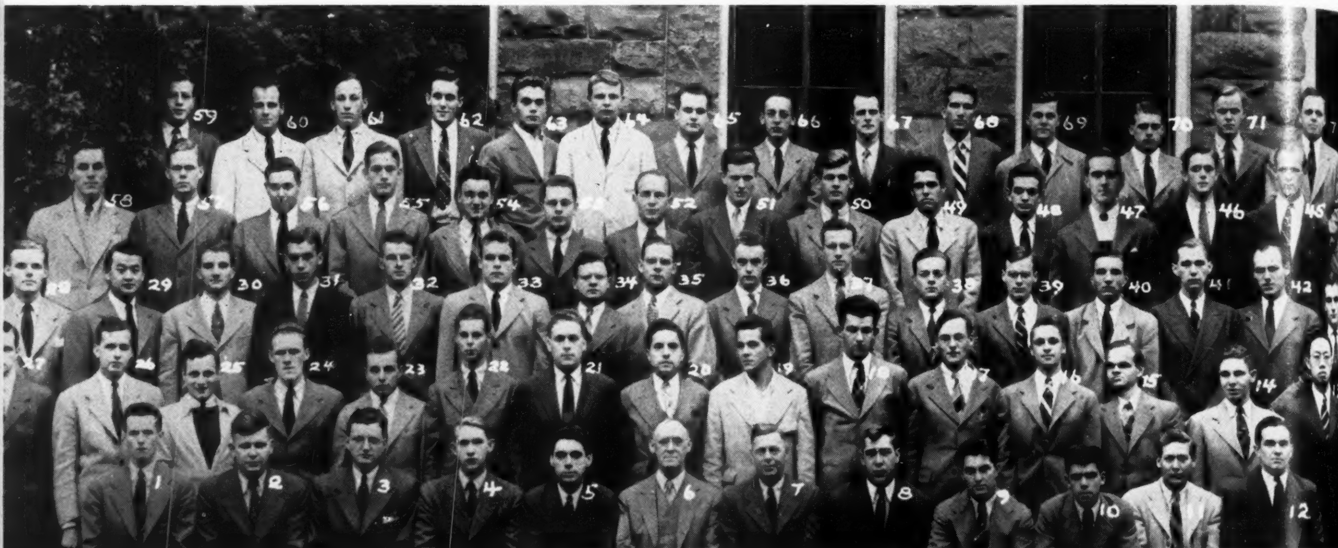
Professor Bangs presided as Chairman of the Management Division on Wednesday and as Chair-

(Continued on page 28)

Senior Class, 1942, Sibley School of Mechanical Engineering

Administrative Engineers

1. Scott, W. H., Jr.
2. Roe, M. E.
3. Schock, H. E., Jr.
4. Hilke, J.
5. Carnes, T. S.
6. Director W. N. Barnard
7. Dean S. C. Hollister
8. Christensen, N. L.
9. Astry, P. D.
10. Smithers, H. L.
11. Lander, R. A., Jr.
12. Seymour, R. L.
13. Chow, N.
14. Schwarz, R. C., Jr.
15. Hazelett, R. W.
16. Guterman, F. H. W.
17. Kositzky, R. G.
18. Rogers, P. E.
19. Tunison, C. R.
20. Levings, W. S.
21. Birckhead, L. M.
22. Taylor, R. F.
23. Grover, R. E.
24. Miller, J. C., Jr.
25. Arenson, E.
26. Caperton, J. H.
27. Read, W. R.
28. Gundlach, R. O.
29. Wu, C. T.
30. Otto, H. E., Jr.
31. Adelson, R.
32. Hurlburt, H. D.
33. Wolff, P. M.
34. Zuckert, W. M.
35. Laird, J. E., Jr.
36. Barrett, N. M.
37. Hart, J. W.
38. Holub, E. M.
39. Hickenlooper, J. W.
40. Irving, C. E.
41. Hogin, P. E.
42. Jones, H. L.
43. Boyle, J. N., Jr.
44. Severinc, M. R.
45. Crichton, W. G., Jr.
46. Sabin, H. B.
47. St. John, H. M., Jr.
48. Crandall, H. K.
49. Galdo, M. J.
50. Locke, J. H., Jr.
51. Jackson, J. T.
52. Munkenbeck, R. W.
53. Brown, R. H.
54. Clarke, F. C., Jr.
55. Ford, R. E.
56. Lewis, L. W.
57. Goodwillie, J. M.
58. Dingle, J. R.
59. Whiting, W. B.
60. Williams, A. D., Jr.
61. Ochs, R. C.
62. Buxton, E. A., Jr.
63. Woodruff, M. F.
64. Riser, F. F.
65. Peters, W. F., III
66. Timmerman, L. D.
67. Upton, S. J.
68. Mead, D. E.
69. Witte, E. B.
70. Howell, G.
71. Hammers, D. H.
72. Middleton, W. H.



Mechanical Engineers

1. Choreyeb, A. T.
2. Brown, I. P.
3. Jopson, H. S.
4. Hu, T. W.
5. Bouton, G. W.
6. Director W. N. Barnard
7. Dean S. C. Hollister
8. Turner, H. L.
9. Ayers, E. F.
10. McNulty, L. A.
11. Graham, R. A.
12. Orbison, F. H.
13. Smith, R. G.
14. Brodhead, S.
15. Green, C.
16. LaCroix, R. E.
17. Wright, G. B.
18. Parker, J. B., Jr.
19. Dowell, A. Y., Jr.
20. Weiss, R. S.
21. Dye, C. F., Jr.
22. Lawrence, W. C.
23. Henderer, W. E., III
24. Stamets, W. K., Jr.
25. Graham, W. D., Jr.
26. Davidson, J. F., Jr.
27. Bridgman, R. A.
28. Ayber, R. M.
29. Kay, S. L.
30. Elizondo, H. R.
31. Mount, J. S.
32. Gifford, F.
33. Novak, C. T.
34. Morrow, R. P.
35. McDonald, W. H., Jr.
36. Resek, R. B.
37. Herbert, W. F.
38. Peelle, L. W.
39. Bull, G.
40. Bacon, F. W.
41. Converse, S. R., Jr.
42. Jones, H. W., III
43. Mead, E. D., Jr.
44. Dayton, J. H.
45. Voecks, W. F.
46. Wells, D. R.
47. Long, L. W., Jr.
48. Goslee, R. W.
49. Merrill, M. M.
50. Walker, B. J.
51. Cuniberti, M.
52. Moulton, L. J.
53. Henrich, C. T.
54. Coors, R.
55. Nitchie, C. M.
56. Caplan, F.
57. Putnam, A.
58. Ornitz, M. N.
59. Hull, J. R.
60. Taylor, R.
61. Rebman, K. L.
62. Fleming, W. C.
63. Schoedinger, F. P., Jr.

PLANE FACTS

With the adoption of the trimester plan by Cornell and other universities, students are looking ahead quite unenthusiastically to a long siege of hard work. But industry, too, is working overtime to produce the materials so essential to our war effort and to solve the many tough problems now thrust upon it.

In the article that follows we have selected from various sources a few items telling of interesting solutions to some of these defense problems.

For instance, in the new engine plant of the Ford Motor Company a large percentage of the power needed for the manufacture of the engines is developed by the engines themselves while they are being given their test runs. First a "shakedown" test which lasts for several hours, must be given to all military aircraft planes; after it, the engines are torn down, inspected for defects, and reassembled for a final run. At our present high production millions of gallons of gasoline are consumed each month in making the tests. The engines are tested under load and in the past they wasted their power into the air by driving special propellors; not only was it wasteful, but it also created problems of noise and heat elimination.

In this new set-up a synchronous generator rated at 720 rpm is connected to an engine through a hydraulic slip coupling arranged so that when the engine speed exceeds 720 rpm, the generator runs at constant speed and delivers power to the plant a-c bus.

Another recently developed item of importance is the electrically heated flying suit. For a long time the Army Air Corps has realized that the ordinary sheepskin-lined flying suit worn by pilots was unable to provide the proper warmth at high altitudes. Now, after months of development and improvement, the Air Corps has approved and awarded a contract for 12,000 electrically heated flying suits.

The new flying suit is designed to keep an aviator comfortable through a 230-degree temperature range (from 70F to -60F). It is wired throughout, and the amount of heat supplied electrically may be controlled to adjust for changes in temperature.

The new suits are cheaper and many pounds lighter than the sheepskin-lined suits they replace, which is of course an advantage in flying, and they will facilitate the manipulation of instruments, controls, and armaments by the aviator.

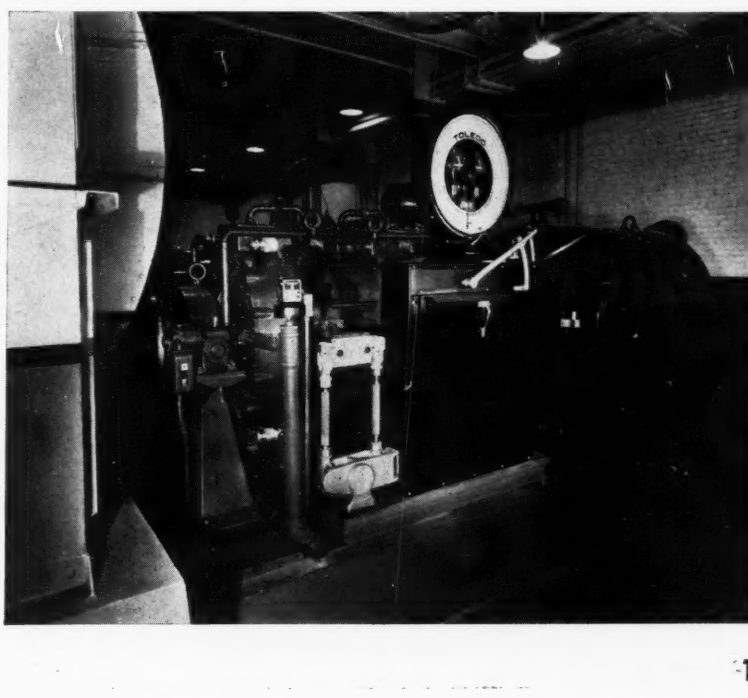
During the investigation, it is interesting to note, the electrically-heated uniform of a German aviator shot down over England was analyzed and found to provide such a small amount of heat that it was practically worthless.

In its final design the suit consists of an outer shell of all wool cut to provide for elasticity. The wires are sewed on the inside of the outer shell. The lining is made of 100 per cent cotton cloth to permit radiation of the heat to the body. The outer woolen shell reduces heat loss to the air. A wired cloth boot of olive drab overcoating, with molded rubber soles, is worn inside standard light aviation boots.

Another important improvement saves aircraft pilots from glare. If the score or more indicator lights before the pilot are bright enough to be clearly distinguished as on or off on a bright day, they will blind him at night if he shifts his gaze from the darkness outside to the cockpit. To control the brilliance by inserting resistance into the circuit requires rheostats as bulky and heavy as the lamps themselves.

But a new method of brilliance control adds neither weight nor bulk to a crowded instrument- or radio-control board. Two layers of Polaroid are placed between the bulb and the lens; one is fixed in position, the other can be rotated by turning the lens. The stationary Polaroid screen polarizes the light in the horizontal direction, say, it blocks all light waves from the lamp except the horizontal. The rotable Polaroid can be oriented to allow all of the horizontally-polarized light rays to come through, or, when turned 90 degrees, to block them. Thus the pilot can obtain from the indicator light any brilliance from full brightness to almost complete darkness by simply rotating a collar on the indicator.

Generator driven by airplane engines on test



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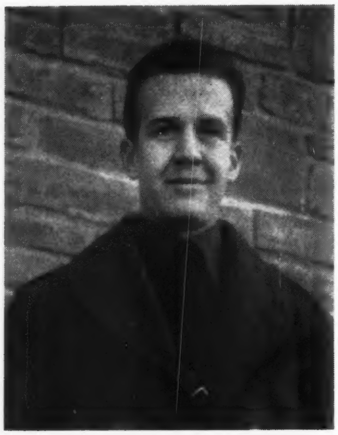


Big John

John Aldworth, AE

CREW Coach Sanford can thank big Norm Christensen for his able Number 7 man, John Aldworth. It all goes back to preschool football practice in John's frosh year. After a few days opposite Big Norm, John decided crew was his sport. However, if you believe this yarn you don't know John. Born and brought up in Garden City, L. I., he played football and lacrosse while in Garden City High. Before he came to Cornell, this tall blond athlete had two major interests, scouting and hitch-hiking. He still likes to tell of his trip to Florida over the road; it took three days to make it and it was a great experience. Eagle Scout Aldworth was all set for the big jamboree in Washington that didn't come off because of an epidemic, but he soon made up for this disappointment with more hitch-hiking and some mountain climbing.

On coming to Cornell, John first went out for football, but soon changed over to crew because most of his friends had become interested in this sport of the mighty. John took over the No. 7 seat and has been in it during every race since his frosh year. During his frosh year he became a member of Phi Sigma Kappa. As an engineer, he has done very well, obtaining, since his admission, a McMullen and a State Scholarship. However, John is very interested in economics, and took administrative engineering mainly because he thought it would help him in this work.

In his sophomore year, John decided that he should associate himself with more activities than crew, and thus he became a member of the Soph Smoker Committee, and was appointed to the Advanced R.O.T.C. In his junior year, John really went to town. By the end of that year he was on the Student Council as secretary, a member of Kappa Tau Chi—AE society, Crew Club, and a member of the Officer's Club. He also is president of Eta Kappa Nu—electrical honorary, Aleph Samach, and Scabbard and Blade, and treasurer of the Officer's Club. He was chairman of the last Ice Carnival Committee.

Last summer, John went to R.O.T.C. camp at Aberdeen, as he is in Ordnance. During the rest of the summer he worked in a machine shop, and acted as counselor at Frosh Camp. This winter he has become enthused about skiing in addition to his favorite, skating. He hopes to increase this interest as time goes on. By the way, John is one of the two undergraduates on the Athletic Council. This year he is also acting as student proctor in the dorms for a very prank-loving bunch of fellows. On graduation, John expects to enter the Army and will try to get into the regulars. After the war — who knows?

Irving Gertzog, ChemE

ALMOST five years ago Irving arrived at Cornell from Rochester, where he says Cornell is looked on almost as being the town's college. Having grown up in an atmosphere of chemistry, and liking engineering, he quite naturally entered the School of Chemical Engineering. Irv did not come in on a scholarship, but since his freshman year he has held at one time or another five or six different undergraduate scholarships, including a McMullen, a LeFevere, and several others which he cannot remember!

However, he does not confine this versatility to scholarships. There is scarcely a sport on the hill in which he has not participated at one time or another. He won his numerals in lacrosse and was on the 150-pound football squad. Irv considers his recent election to Tau Beta Pi the greatest honor he has received, but protested when it was suggested that since he had also been on the Dean's list for all five years, he must spend most of his time studying. He is a member of Retort and Beaker and has been both secretary and vice president, as he says, because he has such vile handwriting. At present he is secretary of the AIChE.

In view of all this, perhaps it will not be surprising to learn that Irv is an inventor, complete with patent. In the button factory where he worked last summer, he was doing research work in the plastics division. During this work he devised an irridescent pigment and a process for mixing it with the plastic so as to form an imitation mother of pearl substance for use in manufacturing buttons. However, Irv prefers to be considered as an engineer rather than as a chemist, and when there was a shortage of executives due to the draft, he was made temporary head of the dyeing department. Here he says he had a grand time with an office of his own, the work consisting mostly of computing for-

(*Continued on page* 28)

Inventor

...mon ...ornell's En...eers

William Graham, ME

BILL Graham calls himself a rather ordinary individual. That is all right if an ordinary individual is one who belongs to four honor societies, ranks well up in his class, heads one important campus committee and is a member of two others, and is president of his fraternity. It remains for the following to show what is meant by ordinary.

William Dalton Graham, Jr., was born in Syracuse somewhat over twenty-one years ago. Attracted by the cosmopolitan atmosphere and the reputation of the engineering schools, Bill decided, when the time came, to attend Cornell. It meant taking an extra year of high school, but Bill did so rather than enter any of the colleges which would have accepted him without further preparation. Though he was originally enrolled in administrative mechanical engineering, Bill later decided that the industrial option was what he wanted, and so became Bill Graham, ME '42.

The summer of his freshman year, reluctant to give up the outdoor life he had been living at summer camps, Bill declined an opportunity to do shop work and took a position as a counsellor at the Syracuse Y.M.C.A. camp. This job was cut short, however, by an attack of appendicitis. This occurred while he was twenty miles from camp, on a canoe trip with a group of youngsters, but Bill managed to get the group back to camp in spite of his illness. A member of the Advanced ROTC, Bill put in a hard six weeks in the Signal Corps camp at Fort Monmouth last summer, and then went canoe-tripping in the Georgian Bay region of Ontario.

Interfraternity Man

A member of Quill and Dagger, Atmos, Scabbard and Blade, and Pi Tau Pi Sigma, Bill has been quite active in extra-curricular fields. He is the incumbent president and last year's vice-president of the Interfraternity Council, and is a member ex-officio of the Student Council. He has participated in interfraternity athletics, representing his house, Sigma Chi, in baseball, football, swimming, and golf. An ardent golfer, Bill turns in scores in the high seventies. He has also served his house as rushing chairman and is now president of the chapter. Bill likes to listen to good music, and possesses a tidy collection of records.

Uncle Sam will add Bill's name to the list of Cornellians serving in the armed forces when he gets his commission next May. And it is fairly certain that Second Lieutenant William Graham, Signal Corps, U.S.A., will serve in just an "ordinary" way.

Professor L. A. Burckmyer

THERE are few men, these days, of the engineering faculty who are not busy, and among the busiest is Professor L. A. Burckmyer of the School of Electrical Engineering. Besides his regular duties as mentor of senior EE's, Professor Burckmyer teaches a defense course in Binghamton, and is conducting a course in direct current equipment for the Naval Reserve men. All of which, as he says, "keeps me hopping."

Professor Burckmyer, a native of North Augusta, South Carolina, entered Clemson College after completing his preparation in the public schools of his home town. Upon graduation from Clemson in 1922 with the degree of B.S. in E.E., he came to Cornell as an instructor, obtaining his E.E. degree in 1924. While instructing, he became a member of Eta Kappa Nu and the AIEE, and for the latter he has done some research work. Assistant professorship came in 1929, and recently Professor Burckmyer was made associate professor of electrical engineering.

Sailor

A devotee of sailboating, it has been his custom, come summer, to doff the mortar board and don a yachting cap. Then, as Skipper Burckmyer, with his wife and two young sons aboard, he will pilot his thirty-two foot auxiliary cutter up and down Cayuga, or in some greater water. Recently, however, work has interferred with pleasure to a great extent. Last summer he was so tied up with research and other work that, save for overnight jaunts, Professor Burckmyer was limited to one week of sailing off Buzzard's Bay, near Nantucket. He has been hoping to get in some cruising on Lake Ontario this coming season, but this hope is being rapidly dimmed.

In addition to yachting, Professor Burckmyer is an amateur photographer, and a rather skilled one, too. For some five years back in the thirties, he spent his summers doing photographic work for the Biological Survey of the New York State Department of Conservation. But now there is not time to indulge in his hobby extensively; so Professor Burckmyer limits his lens work to Kodachrome.

CORNELL SOCIETY OF ENGINEERS

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the College and the alumni."

President's Message

Fellow Cornellians:

C'est la guerre.

Recently, in discussing the future outlook with a young man who had graduated from his college in an arts course with a very high standing, he remarked that there seemed to be no use for brains at this time—that it was more in the line of brawn with a modicum of brain power attached. On second thought, however, he said "I guess I am wrong, it is brains that is wanted,—engineering brains."

The happenings since the writing of my last letter have made some changes in immediate conditions, but there has been no change in so far as the necessity for engineers is concerned. Now more than ever the demand for properly equipped engineers is manifest. Colleges are announcing their intentions to shorten the term of instruction required for a degree, by introducing a summer term. Obviously such a procedure in engineering courses will shorten the years required, and if this is done at Cornell, it should not entail serious hardship. It may cause the foregoing of a summer vacation or summer work; but Ithaca is not such a bad place to spend a summer, even though it may not be home. Altogether such a change would be advantageous to the student as well as to the country which he ultimately will serve. It may even be a stepping stone to a continuation of such a procedure in the future. The old days have gone forever, and perhaps with them have gone some of our old customs.

There will come much discussion of the effects of the war on engineers. It will be the cause of many things, and while it is unholy in every respect, still it will bring for many engineers an unexpected opportunity for the development of talents. Who knows what outstanding idea may be developed by some engineer which will revolutionize many of the fundamental operations upon which the development and production of war material will depend? It is not at all unlikely—it is highly probable—that before the war shall have ended, unprecedented materials and unusual speeds will be attained in construction and production, all dependent to a large degree on the all-out spending which war demands.

C. Reeve Vanneman

So it is incumbent upon engineers to make themselves available—not only the young graduates, but also those who have been engaged in practice and have been employed for many years. Many will find the usual processes with which they have been associated for long times so outmoded that they will no longer be possible; others will find that absence of raw material will make their usual vocations impossible, and they will have to adapt themselves to new conditions and new techniques. The engineer will thus have an opportunity to display his versatility; he will be able to demonstrate that once given the proper background in fundamentals incident to the practice of engineering, he can adapt himself to new conditions within an unusually short time; he may even show the possible falseness of the assumption that long practice is required.

Thus at the beginning of the year and the war, Cornell engineers find themselves with a duty to perform, a duty to their country in presenting all the skill of which they are possessed, of satisfying themselves in the doing of noble deeds, not only heroic ones on the field of battle, but also those equally heroic but unheralded deeds in production, for which they never receive a merited laurel wreath. So it is the war. There is no argument concerning right or might so far as the engineers of this country are concerned. It is a question of life and death, a question of preserving the right to do things freely as they have been done for many generations, a question of the continuance of the Founders' intention when Cornell was begun. May Cornell men have faith in the training which they have had or may receive, and use it. May they have faith in the slow grinding of the mills of God, and the mystery of the ways in which He moves.

Sincerely yours,
C. Reeve Vanneman

The ALUMNI . . .

Joseph P. Ripley

Ripley Heads Board

JOSEPH P. Ripley, M.E. '12, has been elected chairman of the Board of Directors of Harriman Ripley & Co. Inc., investment banking concern of New York City. Mr. Ripley is also chairman of the board of the Cramp Shipbuilding Company, Philadelphia, and a director of the United Air Lines Transport Corp. and of the West Virginia Pulp and Paper Company.

At Cornell Mr. Ripley was a well known campus figure, being a member of Beta Theta Pi, Tau Beta Pi, Sphinx Head, Aleph Semach, and winner of the first Sibley prize in his junior year. Also he was manager of the Cornell crews and active on many campus committees.

Following graduation in 1912, he became associated with the engineering firm of J. G. White & Co., leaving that connection after ten years to go with the investment banking house of W. A. Harriman & Co., Inc., of which he was elected secretary in 1923. In the spring of 1925 he accepted an offer from the National City Company (later the City Company of New York, Inc.) and was executive vice president of that company when he resigned in 1934 to head the firm that later became Harriman Ripley & Co. Inc.

Gennet Honored

CHARLES W. Gennet, Jr., M.E. '98, was awarded an Octave Chanute Medal for the best paper in electrical engineering presented before the Western Society of Engineers in 1940-41, according to an announcement from the society. Mr. Gennet is vice president of Sperry Rail Service, a division of Sperry Products, Inc. in Chicago.

The paper for which the medal was awarded, "Progress in the Detection of Defective Rails," describes the equipment and methods developed during the last ten years for discovering fissures and other defects in the rails on railroads. The Sperry Rail Service has several cars in constant operation which set up electric circuits in the rails, show the defects on a continuous tape, and mark the spots on the rails with paint. "In the years of our operation," Mr. Gennet says, "a total of nearly 500 miles of rails containing transverse and compound fissures have been detected and removed from the track, while something over 600 miles of otherwise defective rails have also been located by detector cars."

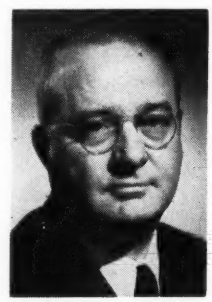
Recent developments include the use of two circuits instead of one, in order to make a double check; a more accurate system of placing the paint spot on the exact location of the defect; and a more sensitive type of detector, so that engine burns and other defects not dangerous to traffic can be separated from true fissures in reading the tape.

Winner of the Octave Chanute Medal in Mechanical Engineering for 1939-40 was Gustav Egloff, also of Chicago, for a paper on "Motor Fuels of the Present and Future." He is also an alumnus of Cornell University in the Class of 1912.

The Willard Gibbs Award

THOMAS Midgley, Jr., M.E. '11, discoverer of tetraethyl lead, which has made possible great advances in automotive and aircraft engines, was recently awarded the 1942 Willard Gibbs Medal by the American Chemical Society. Dr. Midgley was cited for "discoveries which are outstanding both from the standpoint of pioneering in new fields and from the standpoint of commercial importance." Other achievements of the winner include the development of safe refrigerants and contributions to synthetic rubber research and to methods of extracting bromine from sea water.

The performance of modern military and transport planes is credited in large part to the developments of high octane gasoline,



Dr. Thomas Midgley

a development in which tetraethyl lead played and important role. Dr. Midgley discovered tetraethyl lead in 1922 after he and his colleagues in the General Motors research laboratories had tried more than 33,000 compounds without success.

(*Continued on page* 22)

Shipbuilding

(*Continued from page 6*)

unless he has made them, nor how to design machine work unless he has done so. This experience he must have in addition to all the theoretical knowledge necessary for the designs. Some of the leading men and best designers in the drawing rooms are similarly foreign-born American citizens, and many of the chargemen and leading men are ex-apprentices; but it is gratifying to say that the shipbuilding yards are now beginning to find excellent material among the graduates of American engineering colleges.

The encouraging feature of the present situation is that an engineering graduate is paid from the very beginning in the drawing room a wage that provides a very respectable living. For a 40-hour week he is at present paid $1664 a year with ten work day holidays with pay, which is more than a first-class top-notch draftsman received in 1900. As a ship draftsman is now usually working 49½ hours a week, with time and a half for overtime, he is actually receiving about $2,250 a year. A first-class top-notch draftsman in the same way is now receiving about $4650 a year, which is more than a chief draftsman received in 1915. Living costs have of course gone up to some extent, but not in proportion to pay.

Yes, there are all kinds of opportunities in shipbuilding, and one does not have to immediately become president or vice-president of the company in order to make a fairly respectable living and have a lot of fun out of life. In fact one sometimes suspects that the boys out in the yard and over the drawing boards have just as much fun in life, if not more, than some of the higher-ups. However, none of this is to say that recognition and real advancement do not require the very best preparation and plenty of hard work every minute. The competition is keen, and you may be pretty sure that one who does get ahead has worked hard and is in some respects, at least, a real person.

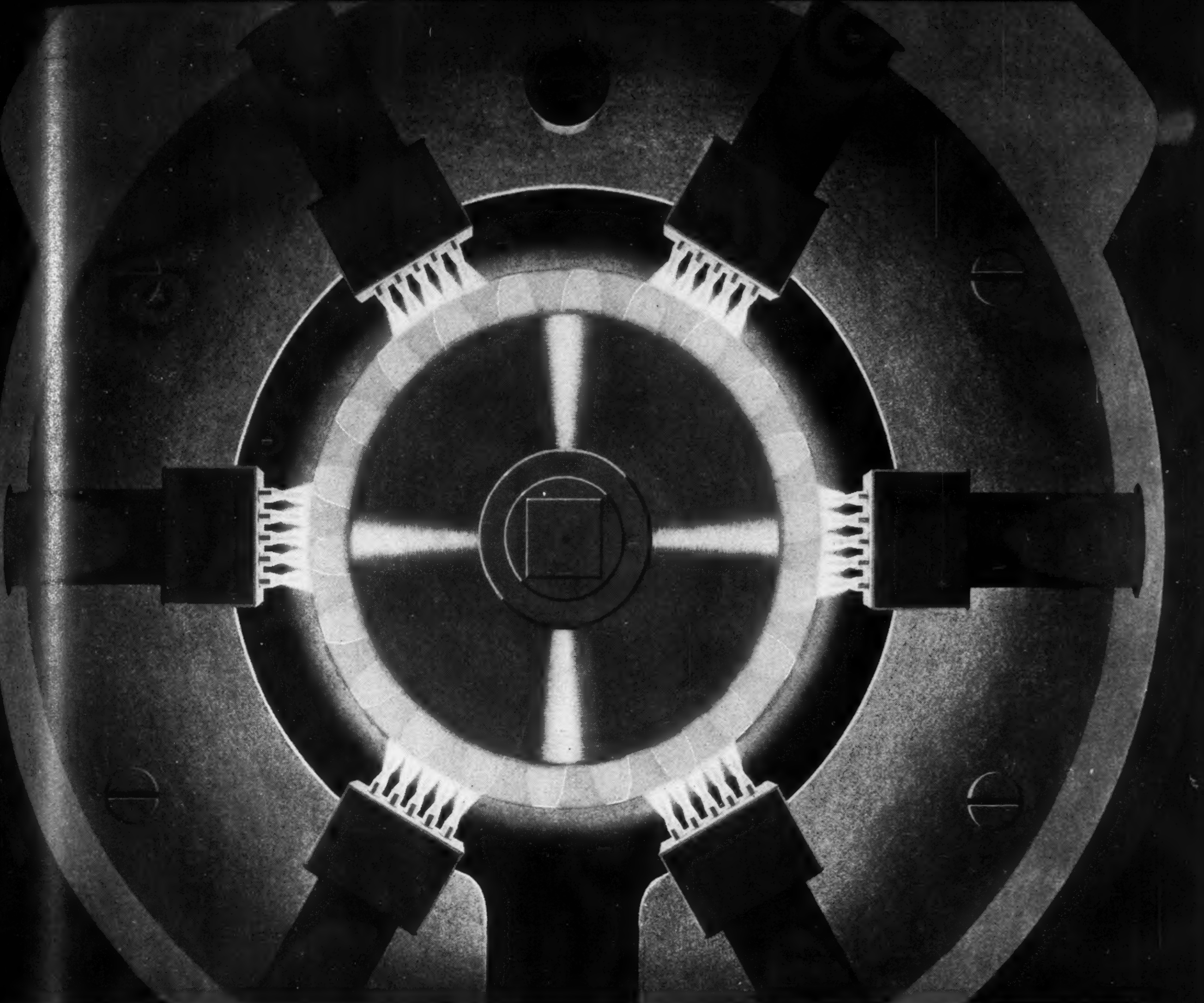
The ALUMNI

(*Continued from page 20*)

JOSEPH Breslove, M.E. '37, recently joined America's expanding Naval air force as a skilled pilot. He was awarded his coveted Navy wings and a commission as ensign in the Naval Reserve after successfully completing a training course at the huge Naval Air Station in Jacksonville, Florida. He is now prepared to take his place with the many patriotic young men who are making the Navy's powerful patrol planes and speedy observers into two-ocean guardians.

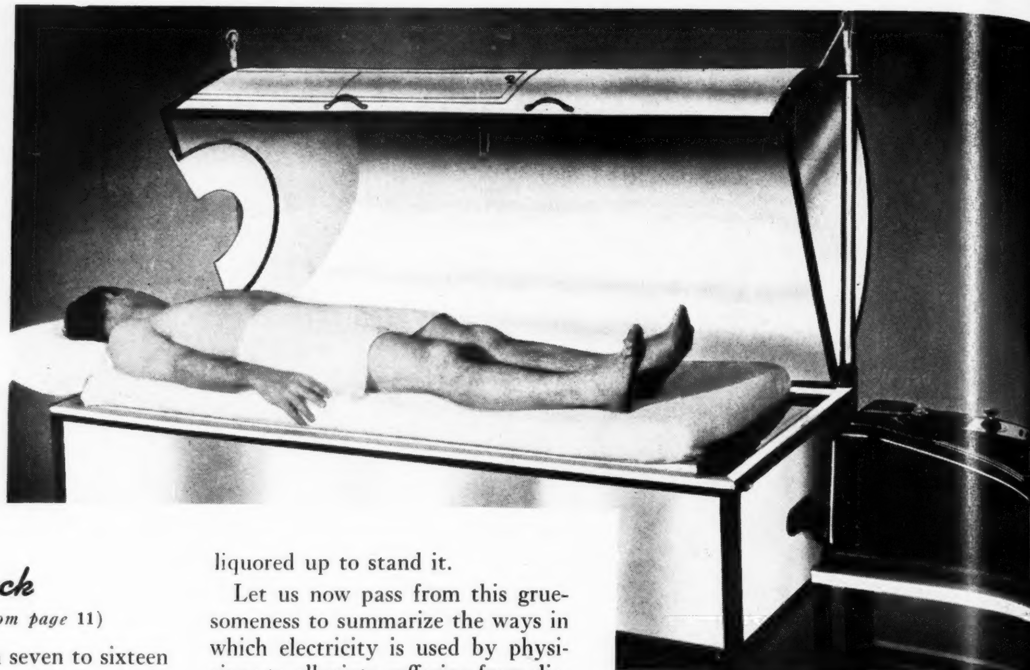
Student pilots who go to Jacksonville are given thorough instructions in what makes Uncle Sam's warplanes run as well as in how to run them. Their course includes intensive work in ground school, where such subjects as aviation engines and structures, aerology, gunnery, and communications are mastered. As far as the actual flying is concerned, they learn to pilot planes ranging from the slow mov-

(*Continued on page 28*)



Right: Artificial fever by short wave diathermy

Below: Short waves being used to relieve muscular aches



Electric Shock

(*Continued from page* 11)

times in all. From seven to sixteen amperes course through the victim's body.

The effect of all this when properly performed is believed to be instantaneous and painless death. Much has been written to dispute this point, but the weight of medical opinion seems to confirm it. According to Dr. Amos O. Squire, for many years chief physician at Sing Sing State Prison, the effect is like that of a terrific blow on the top of the head. Consciousness vanishes instantly, because the current travels to the brain and paralyzes it faster than the nerve sensation can travel.[11] To make assurance of death doubly sure, the law requires that an autopsy be performed immediately after the execution. After this there is no longer any doubt.

All the above fails to take account of the gory details of electrocution. According to an eyewitness account[12] the unconscious body seems to be suffering intensely, as if fighting against the current with every ounce of strength. The bodily juices stew out of every pore, emitting the pungent odor of roast pork. No cameras are allowed in the death chamber. Words can be toned down, but pictures are too vividly accurate. Reporters whose duty it is to witness the killing have to get liquored up to stand it.

Let us now pass from this gruesomeness to summarize the ways in which electricity is used by physicians to alleviate suffering from disease. All the direct applications of a beneficial current, with the various results thus gained, can be summed up under five heads.

Electrotherapy

The first type is the application of a constant current causing a reflex stimulation of the skin. Acting as a "counter-irritant", this treatment increases the blood supply. It is used in local treatment of chronic rheumatics, neuritis, sprains, and many other local conditions.

The second method is the use of static electricity in treatment of the nerves. In expert hands, charges are used to quiet the nerves and induce sleep.

The third type of treatment consists of stimulating paralyzed muscles with an intermittent electric current of suitable frequency, so as to restore functions to these muscles.

Electric shock treatment of mental disease is the fourth use. Such diseases as schizophrenia have been widely treated with shocks produced by drugs like insulin and metrazol. It has been discovered quite recently that electric shocks work just as well and are easier on both doctors and patients. The patient always loses consciousness and awakens slowly, with no memory of the experience.

This treatment, also used for epilepsy, was originated in Rome and was introduced to American physicians at the New York State Psychiatric Institute by Dr. Lothar Kalinowsky. Two 1/10-second shocks are administered—the first of 500 milliamps and the second of 750 milliamps. The reader may

(*Continued on page* 26)

11. Squire, Amos O. *Sing Sing Doctor.*
12. Potter, Charles P. "I Saw a Man Electrocuted" *Readers Digest* February, 1938; page 70.

8. Kearney, Paul W. "Watch Your Wires" *Readers Digest* June, 1936; page 93.
9. *Newsweek*, August 19, 1940; page 46.
10. Elliott, Robert G. "As Humane as Possible" *Colliers* October 15, 1938; page 19.

Electric Shock

(*Continued from page* 24)

inquire why such shocks do not cause ventricular fibrillation of the heart. The answer lies in the fact that the current path is from temple to temple, thus letting little of the current reach the heart. "Several thousand fits have been produced on some hundred patients . . . ," reported Dr. Kalinowsky, "without any accident whatsoever."[13]

Short Wave Diathermy

The last type of electric treatment is the most widely known of all. Commonly called short-wave diathermy, it is administered yearly to more than 300,000 persons. This treatment is based on the observed fact that high frequency currents induced in the body produce a beneficial artificial fever. Administration of this fever requires experienced, specially trained doctors. The fever works in two ways—it kills some germs directly by the heat (e.g. gonorrhea germs), and it helps the body to fight the germs by causing an inflow of blood.

Another type of diathermy has recently come into great vogue. The heating effect of these machines can be controlled so as to heat only a certain organ or limb to any specified temperature. In an effort to offset this heat, the blood flow increases, the capillaries dilate, waste matter is carried off faster, and healing is stimulated. The beneficial effects of such heating have long been widely known, but while heat applied directly is stopped by the skin and surface layers of tissues, diathermy's great advantage is that it penetrates deep into the tissues where the heat is needed.

Diathermy machines for home use are on the market, but their use is inadvisable unless under the direction of a physician.[14] Severe burns can be inflicted by amateur handling of such machines. It might be well to add at this point that numerous quacks have duped the credulous with a countless variety of worthless electric and magnetic "cure-alls."[15] It is well to consult a reliable physician before wasting money or risking health on any such device.[16]

There is one more interesting use of short-wave diathermy—the surgeon's electric knife. By replacing one of the energy transmitting pads with a metal point, the heat is concentrated and intensified so as to be suitable for coagulating and destroying tissue.

Conclusion

Thus we see that electricity, like almost every branch of science, can be friend or foe, depending upon how it is used. When carelessly handled, it inflicts pain, injury, and sudden death. But the same stream of electrons, guided by wise hands, reverses that action and becomes a healer of mankind.

13. *Science* January 19, 1940; page 10 of supplement.
14. Waldron, Webb. Article on short wave diathermy in *Hygeia*, February, 1940; page 119.
15. Cramp, Arthur J. Article on quack electric and magnetic cures. *Hygeia* May, 1938; page 439.
16. *Hygeia* January, 1936; page 24.

Additional Reference

1. *Encyclopedia Britannica* (14th Edition)—Articles on electrotherapy and electrocution.
2. *Hygeia* Fever diathermy. May, 1939; page 400.
3. *Scientific American*—Article on electrotherapy. September, 1940; page 127.
4. Van de Water, Marjorie. "Electric Shock, a New Treatment." *Science News Letter* July 20, 1940; page 42.

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The ALUMNI

(*Continued from page* 16)

ing Stearman trainers to the speedy types of combat aircraft.

Aviation cadets at Jacksonville and the Navy's other two flight training centers at Pensacola, Fla., and Corpus Christi, Texas, are young men between 20 and 27 years of age with at least a two-year college education.

FREDERICK C. Wood, M.E. '28, has been appointed manager of the York Ice Machinery Corporation in York, Pennsylvania. His work will be concerned with the application of industrial air conditioning with respect to vital defense production.

Wood entered the York Ice Machinery Corporation as a student engineer immediately after graduation.

Among the Engineers

(*Continued from page* 16)

mulas for the dyes and working out the various details of the operations.

Scholastically his interests are not at all narrow; he has no major subject and at present he is taking courses in nutrition and bacteriology, more because they interest him than for any practical use he may have for them. He will receive a commission in the Naval Reserve when he graduates. He chose the Navy because he enjoys being on the water; in fact, he spends as much of his summer as he can on boats—and now he discovers that he is slated to be put on land duty! He does not mind being in the Navy, saying that those who possess special education should do what they can for their country. When the present emergency is over, he plans to enter the field of production engineering.

The COLLEGE

(*Continued from page* 13)

man of the Industrial Marketing Session on Thursday morning.

Following this meeting, Professor Bangs addressed the Cornell Club of New York on "Your Job and National Defense."

EE's To Study Microwaves

DURING this next term, at the request of the National Research Council, a special course in Ultra High Frequency Techniques will be given in the School of Electrical Engineering. The course includes a theoretical consideration of some of the new vacuum tubes which are useful in high frequency work, such as the klystron and the magnetron. There will also be a certain amount of laboratory testing of high-frequency oscillators, antenna arrays, and allied equipment.

This course is being given under the auspices of the U. S. Office of Education's Engineering, Science, and Management Defense Training program. This is the first course given under this program which gives college credit, the other courses having been given to men already employed in industry. The course was given strong backing by the Federal Government because

(*Continued on page* 30)

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LEADING the attack on the production backlog by shaping steel and building it into ships, tanks, armored trucks any many other defense items, is industry's modern production tool — the Airco Oxyacetylene Flame. It slices its way through steel of any thickness up to 30" and more, cutting it to the desired contour with unrivalled speed and accuracy. This versatile tool flame machines metal with astonishing speed; hardens steel to any desired degree and depth; cleans metal surfaces for quicker and longer lasting paint jobs and welds metal into a homogeneous lastingly strong structure.

To assure the maximum efficiency from this modern production tool, Airco has developed a complete line of machines and apparatus. Airco has increased its manufacturing of oxygen and acetylene and distributing facilities to meet the accelerating demand. So that the Airco Oxyacetylene Flame may be used most efficiently and economically, Air Reduction offers industry the cooperation of a staff of experienced engineers, skilled in the use of this modern tool.

An interesting booklet, "Airco in the News", tells a picture of this Airco production tool and the numerous ways in which it is aiding the defense program. If you want a copy write to the Airco Public Relations Department, Room 1656, 60 E. 42nd St., New York, N. Y.

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Defense Training

(*Continued from page* 8)

The instructional material for inspector training has been made available to the various schools in New York State and elsewhere, and at present many courses are in operation, training inspectors for the Ordnance Department and for the industries manufacturing war equipment.

A recent development is the course now being started in one engineering college in each of the seventeen Ordnance Districts, for the training of Ordnance inspectors who are on the payroll of the Ordnance Department and who are sent to these colleges for special training. The National Defense Curriculum Laboratory at Cornell was asked by the Office of the Chief of Ordnance to prepare a special course of study covering a training period of 90 days, based upon the instructional material previously developed and now in use in the vocational schools and in some engineering colleges. This special course was prepared, approved by the U. S. Office of Education, and is now being put into operation in the seventeen selected engineering colleges.

Cornell was selected as the training agency for this special program for the Rochester Ordnance District. An inspection laboratory has been provided by partitioning off the east end of the third floor of Rand Hall, equipment and parts to be inspected have been secured, and the program is expected to be under way by the time this article is printed. The trainees will receive instruction in mathematics applied to inspection, blueprint reading, materials of industry, manufacturing processes, and inspection practice including class and laboratory work. Professor Garret is in charge of this program.

The College of Engineering has made significant contributions to the total war effort through the extension classes offered in the various cities in central and western New York, and through the special diesel engine course offered on the campus for Naval ensigns. It is hoped that the training program for inspectors will be another significant contribution.

The COLLEGE

(*Continued from page* 28)

of the shortage of men with technical training necessary in the use of the new high frequency apparatus used by the military forces. Dr. Howard Smith has attended conferences at M.I.T. for prospective instructors in the course. In the School of Electrical Engineering the lectures and laboratory work will be conducted by Professors W. C. Ballard and True McLean, Dr. Smith, and Mr. A. B. Credle.

New Math Course

To meet the needs of students who are contemplating entry into the Navy or other branches of the service requiring a knowledge of navigation, a new three-hour course, Mathematics 16, has been announced by the department of mathematics. It includes a study of spherical trigonometry and map projects.

STRESS *and* STRAIN...

At three in the morning, five-year-old Arthur asked his mother to tell him a story.

"Quiet, dear," replied his mother. "Daddy will be in soon and tell us both one."

* * *

A man rushed into the newspaper office and demanded to see the editor. "Sir," he cried as he walked around the room, "your paper has libeled me. You have called me the lightweight champion."

"But that is true," returned the editor. "You are Mr. Fightwell, aren't you?"

"Yes, yes," cried the other, "but it's my brother who is the boxer. I'm a coal merchant."

* * *

I tried to kiss her by the mill
One starry summer night,
She shook her head and sweetly
  said,
"No, not by a damn site!"

A manufacturer recently sold seven gold-plated bath tubs at $2,500 each to residents of Long Island. Sounds like a swell way to soak the rich.

—Rose Technic

* * *

"I'm going to leave school unless the dean takes back what he said."

"What did he say?"

"Get out!"

* * *

I think that I shall never see
  An auto like the Model-T;
A car whose three-inch tires are
    pressed
  Against the earth's rough, stony
    breast;
A can who looks for gas all day,
  And blows a radiator spray;
A crate that in the summer goes
  And freezes up when first it
    snows;
A crank with which we often toil;
  Four cylinders that eat up oil;
Poems are made by fools like we,
  But only Ford can make a T.

Cut courtesy PUBLIC UTILITIES FORTNIGHTLY

"We're looking for a place with a street-light outside the bedroom window — we like to read in bed."

She: I'm perfect.
He: I'm practice.

Junior Week Specials

Mother: Have a good time at the houseparty and be a good girl.

Daughter: Make up your mind, mother.

* * *

He: Since I met you I can't eat, I can't drink, I can't sleep.

She: Why not?

He: I'm broke.

* * *

Mary had a little lamp,
It was well trained, no doubt,
For every time that Johnny came
The little lamp went out.

* * *

It's nice to kiss in a shady parking place, but the boy friend doesn't stop there.

You mean . . .

Yes, he keeps right on driving.

* * *

I was struck by the beauty of her hand.

I tried to kiss her.

As I say, I was struck by the beauty of her hand.

In the U. S. last year 4,076 people died of gas.

29 inhaled it.

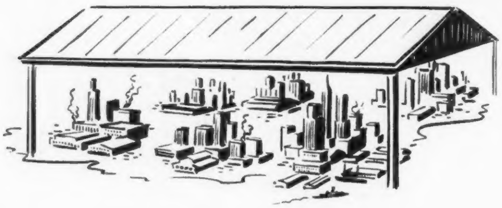
47 put a match to it.

And 4,000 stepped on it.

* * *

Last night I held a little hand
So dainty and so sweet,
I thought my heart would surely
  break
So wildly did it beat.
No other hand in all the world
Can greater solace bring,
Than that sweet hand I held last
  night—
Four aces and a king.

G-E Campus News



UNDER ONE ROOF

THE General Electric Company has a leased-wire communication system which functions as smoothly as if all G-E branches were housed in a single building.

During the year 1941, a total of 3796 miles was added to the leased-wire communication system to help speed the handling of contracts. A network of 11,565 miles is now available for telephone and teletype messages.

The telephone network covers 5630 miles and serves 17 key industrial cities in the East and Middle West. It contains 37 individual wires, many of which can be interconnected for greater flexibility and coverage. The teletype network comprises 4822 miles of full-time circuits and 1113 miles of part-time circuits. Thirty-one cities are served directly, and many others are served indirectly.

VOLTS AND VITAMINS

THE General Electric industrial X-ray laboratory recently moved a large number of apple and other fruit trees, berry bushes, and tomato and string bean seeds into the confines of its workrooms.

There, under an X-ray machine, these various specimens of flora were bombarded with 1,000,000-volt X rays. They were then returned to the New York State Experiment Station at Geneva for planting and subsequent observation of the effect of the X rays upon the color, size, flavor, quality, resistance to disease, and other characteristics of the fruit and vegetables.

Variations and mutations are to be expected when living plant cells are subjected to bombardment with X rays. Under forced germination, effects of the 1,000,000-volt treatment on seeds may be observed within a few days, but, for the young trees and berry bushes, the full effect will not be known for at least five years.

LE DERNIER CRI

THE General Electric Company's construction of the first large electric plant in the Belgian Congo was stalled by the lack of dowel pins, the only items missing from an inventory of hundreds of parts. The whole camp was searched, natives were questioned, but not a single dowel pin was found.

With a 90-day deadline, replacements were out of the question, so, with makeshift materials, tools, and help, new dowel pins were fashioned. The job was finished on schedule.

Months afterwards a visitor to a half-savage tribe in the Belgian Congo found men and women alike wearing a new type of nose ornament. Thrust through the cartilage of the nose, gleaming and twinkling in the African sunlight, the missing dowel pins were the pride of the natives.

GENERAL ELECTRIC

953-82-211